Wolf Eagle Environmental

"Advancing Industry while Protecting the Environment"

# Town of DISH, Texas

# Ambient Air Monitoring Analysis

## Final Report

Prepared by:

Wolf Eagle Environmental

September 15, 2009

## 1.0 Executive Summary

Wolf Eagle Environmental ("Wolf Eagle") was retained by Mayor Calvin Tillman and the people of DISH, Texas ("Client") to perform an Ambient Air Monitoring Analysis study in the Town of DISH. The purpose of the study is to characterize the ambient air quality in the Town of DISH. DISH (previously called Clark) is located in Denton County, Texas and has a population of approximately 200 people. DISH is a bedroom community located between the cities of Ponder and Justin in Denton County, Texas. It is comprised of primarily residential homes on acreage surrounded by rural atmosphere. Many of the residents have horse breeding farms. Recent gas well development and erection of numerous compression stations have residents concerned about the environmental impact to the Town, residents, livestock, as well as concerns for impact on property value. The Barnett Shale geologic formation runs under the Town of DISH. Development of the gas industry in a residential area can cause degradation of Quality of Life (QOL), general annoyance to human populations, as well as noise, air, water, soil contamination and vibrational disturbance of foundations of buildings. Recently, seismic anomalies have been seen in areas of North Texas where gas drilling and exploration activities were ongoing. These areas are inconsistent historically with seismic activity. Research is currently in progress to assess whether drilling has been a precursor to the recent seismic activity.

## 2.0 Background Information

Wolf Eagle was contacted by Client to perform ambient air monitoring after numerous gas exploration companies erected compression stations on Town property and on property directly adjacent to Town boundary lines. The stations were built adjacent to one another on the corner of Tim Donald Road and Strader Road on property owned by the Bennett family. The compression stations are owned by five (5) different entities and are identified (from west to east) as Crosstex, Chesapeake, Atmos, Energy Transfer, Enbridge. Many of these sites have multiple compression engines ('compressors') varying in size (1,231 to 3,500hp) as well as support equipment that emits fugitive emissions (condensate tanks, truck rack, site fugitive and compressor blowdown emissions). The size, horsepower and age of each compressor vary at

each station. In July of 2009, several metering stations were erected just west of the compression stations. These facilities are located adjacent but owned separately by Atmos, Crosstex and Enterprise. Directly to the north of the compression and metering stations are residential homes on acre lots. Approximately 0.35 miles north of the multiple compression stations Devon Gas installed 10 condensate tanks directly adjacent to and what appears to be in the boundary of a new residential development of smaller lot sizes. The Town of DISH has current ordinances regulating the drilling and production of gas wells within the Town boundaries, however, as often occurs in rural areas, several of the compression stations were sited directed outside those boundaries where no ordinance or regulations apply. Numerous complaints had been made to the Town in regards to the constant noise and vibration emanating from the compression stations as well as foul odors prior to Client contacting Wolf Eagle. Of particular concern to Wolf Eagle were reports of young horses becoming gravely ill and several deaths over the past two years with unknown etiology.

**3.0 Weather Conditions**

Weather conditions on 17 August, 2009, were confirmed at Denton Municipal Airport (03991) Denton, Texas. Sky conditions were clear with temperature ranges from a low of 77 degrees Farenheit to a high of 98 degrees Farenheit. Winds were reported calm out of the southeast at an average wind speed of 9.0 miles per hour with occasional wind gust up to 20 mph.

**4.0 Ambient Air Sampling**

On 17 August 2009, with favorable weather conditions for ambient air testing, Wolf Eagle began ambient air monitoring on numerous locations near the previously identified compression stations. Advance notice was given and permission granted by all property owners prior to accessing any property. Upon arrival at the Town of DISH, technicians performed a visual inspection of the compression stations. All appeared to be online with visible emissions present from the farthest east compression station. Vegetation in the immediate area showed signs of leaf discoloration and heavy particulate matter accumulation. Several large trees were dead with visible indication of leaf and limb scalding on surrounding trees. Emissions were visible and within the immediate vicinity of the trees. Considerable noise was present in all directions favorable with the wind patterns. Compressors exhibited both the operation high pitch whirl as indicated by elevated decibel readings and heavy low decibel vibration tones. Additional noise was observed east of the compression stations from the highway (FM Road 156). Occasional airplane noise was observed. Testing began on Chisum Road at approximately 12:12 pm on 17 August, 2009.

Wolf Eagle performed whole air emissions sampling for volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) as well as Tentatively Identified Compound (TICs) on multiple

locations. Sampling procedures followed ASTM Method D31357 using certified sterilized evacuated pressurized stainless steel Summa canisters with 24-hour flow regulators (certified mass flow 24-hour meters) obtained from a certified air testing laboratory (GD Air Testing, Inc., 551 N. Plano Parkway #429, Richardson, Texas). All canisters were certified with both a canister number and canister batch from the laboratory verifying proper evacuation and pressurization. All canister locations were verified by GPS coordinates. The initial time of can depressurization (opening) was noted and recorded on the chain of custody. Upon completion of sampling the hand valve was closed, brass cap secured and time of closure noted. Canisters were collected on 18 August, 2009 at approximately 11:45 am, inspected for damage or dents that could impact quality of samples. No dents or damage to any canister or flow meters were noted. The canisters were returned to the certified testing laboratory in a timely fashion to insure quality of sample with proper chain of custody.

A TO-14[1] (Toxic Organic Compounds) VOC analysis or multiple volatile organic compounds and a Tentatively Identified Compounds (TIC), along with Fixed Gases and NOX were requested and subsequent report characterizing compounds was produced by the independent laboratory.

([1]The TO-14 is the original and most common method used to test ambient air for toxic organic compounds and recommended procedure according to the U.S. Environmental Protection Agency (EPA). The TO-14 covers the widest range of volatile organic compounds reporting 40-different species.)

## 5.0 Location of the Monitors

In total seven (7) monitors were placed on resident's properties (See Section 2 Maps – Air Monitor Locations). The locations due north of the compression stations were chosen due to the wind pattern of that day and also to provide analysis of air emissions near human populations. Placement began 1212 hours (12:12 pm CST) on 17 August 2009, ending at approximately 1232 hours (12:32 pm CST) on 18 August 2009. GPS coordinates and canister information can be reviewed in Section 3 Monitor Field Data.

## 6.0 Laboratory Results

The International Agency for Research on Cancer (IARC) was established in 1965 through a resolution of the XVIII World Health Assembly, an extension of the World Health Organization. The mission of the IARC was to coordinate and conduct research on the causes of human cancer. Thousand of chemicals have been classified by the IARC as to their potential for carcinogenesis. The National Toxicology Program (NTP) was established by Joseph Califano, Jr. Secretary of Health, Education and Welfare to coordinate toxicology testing and provide information about potentially toxic chemicals to health, regulatory, research agencies, scientific and medical communities in the United States. The NTP categorized chemicals as *Recognized*

*Human Carcinogens* or *Suspected Carcinogens* based on decades of laboratory and epidemiological studies confirming the chemicals capability to cause cancer in humans or animals. In addition, the U.S. Environmental Protection Agency (E.P.A.) has developed a system that ranks chemicals based on their chronic toxicity to human health. The E.P.A. has determined acceptable risk levels of exposure to humans in an effort to establish industry standards for safe exposure. E.P.A.'s Risk Screening Environmental Indicators (RSEI) project is used to evaluate the potential health impacts of chemicals releases reported to the Toxic Release Inventory. The RSEI assigns a "toxicity weight" to a chemical relative to how its risk assessment values for cancer and non-cancer health effects compare to other chemicals. Within each category, limits of chemical exposure to humans are identified and separate toxicity weights assigned for ingestion and inhalation exposures. The limits have become the basis for establishing regulatory standards. The categories are defined as the following:

- Recognized Human Carcinogen
- Suspected Human Carcinogen

State regulations may adopt risk levels more restrictive to the Federal guidelines or at their choosing may adopt the existing risk levels identified by the E.P.A. The State of Texas chose to not implement more restrictive regulations, as other states have, but rather chose to adopt the Federal guidelines and standards for safe exposures. The Texas Commission on Environmental Quality (TCEQ) in a February 13, 2009, Memorandum Identified the latest updated list of Effects Screening Levels (ESLs) now currently in use by the TCEQ Toxicology Division for air permitting. This list is the commonly referred to database used to evaluate exposures to toxic compounds and the associated potential for adverse human health effects to occur as a result of the exposure. These ESLs are based on research data established by the IARC, NTP and U.S. EPA . The ESLs are established limits of exposures to chemicals based on their potential for adverse health effects, odor/nuisance potential and effects on vegetation. Weighted toxicity levels are identified as both Short-term ESLs and Long-term ESLs. Short term ESLs indicate a 1-hour averaging period and Long-term ESLs indicate an annual averaging period. Both values are identified in micrograms per cubic meter (ug/m3) and parts per billion (ppb). All compounds are identified with a CAS Number to insure consistency and proper identification due to numerous chemicals with multiple names. An additional note is made of a double asterisk (**) after the constituent name which indicates the constituent has a disaster potential.

Disaster potential as identified by TCEQ guidance document present in draft form defines disaster potential as chemicals with:

- high toxicity to human life
- moderate to high vapor pressure, or easily volatilized
- high vapor density that causes the vapor to resist dispersion or hug the ground

- chemical is to be stored, in high pressure operating areas, or otherwise handled in sufficient quantity to support a dangerous off-plant impact
- chemical with an IDLH value, or one that could reasonably be expected to have impacts immediately dangerous to life and health

**Laboratory results confirmed the presence of multiple Recognized and Suspected Human Carcinogens in fugitive air emissions present on several locations tested in the Town of DISH. The compounds identified are commonly known to emanate from industrial processes directly related to the natural gas industrial processes of exploration, drilling, flaring and compression. The laboratory results confirmed levels in excess of TCEQ's Short Term and Long Term ESLs. In addition, several locations confirmed exceedences in a chemical identified by TCEQ with the capability for 'disaster potential'. (See Section - Laboratory Results)**

The Town of DISH has virtually no heavy industry other than the compression stations. There is no other facility with the capability to produce the volume of air toxins present within miles of the Town. Fugitive emission sources of hazardous air pollutants emanating from the oil and gas sector include emissions from pumps, compressors, engine exhaust and oil/condensate tanks, pressure relief devices, sampling connections systems, well drilling (hydraulic fracturing), engines, well completions, gas processing and transmissions as well a mobile vehicle transportation emissions. Along with hazardous air pollutants (HAPs) and known carcinogenic compounds, air toxic compounds that contribute to smog formation were identified and are a known emission of gas industrial exploration, compression, processing and distribution.

## 7.0 Discussion

Many chemicals identified in laboratory results at several locations tested were found to exceed TCEQ's ESL's. These chemicals include Benzene, Dimethyl disulfide, Methyl ethyl disulphide, Ethyl-methylethyl disulfide, Trimethyl benzene, Diethyl benzene, Methyl-methylethyl benzene, , Tetramethyl benzene, Naphthalene, 1,2,4-Trimethyl benzene, m&p Xylenes, Carbonyl sulfide, Carbon disulfide, Methyl pyridine, and Diemethyl pyridine.

Benzene – CAS Number 71432

Benzene exceedences occurred in both Short-term and Long-term ESLs according to TCEQ limits. The most important toxic effect of benzene is hematopoietic toxicity. Chronic exposure to benzene has been shown to lead to bone marrow damage, initially manifesting as anemia (reduced level of oxygen carrying pigment hemoglobin in blood), leucopenia (decreased total number of white blood cells in the blood) and thrombocytopenia (reduction in the number of platelet cells in blood) often with resultant marrow aplasia (incomplete or reduced growth or development), pancytopenia that can progress to myelogenous leukemia and death. Medical research indicates and supports Acute myelogenous leukemia (AML) strongly correlated to high

benzene exposures in humans. Benzene is often seen in the common acronym of BTEX (Benzene, Toluene, Ethylbenzene and Xylene). These compounds are some of the volatile organic compounds (VOCs) found in the oil and gas industry. Many of the BTEX chemicals were the first to be identified by EPA as "known human carcinogens" with harmful effects on the central nervous system.

Xylenes – CAS Number 1330207 (m&p-) and 95476 (o-)

Xylene exceedences occurred in both Short-term and Long-term ESLs according to TCEQ limits. Xylene is a member of the common acronym BTEX due to its association with the other aromatic hydrocarbons. The primary uses of Xylenes industrially are as solvents and synthetic intermediates. The toxicity of BTEX and other aromatic solvents are similar. Xylenes are absorbed readily in the lungs and GI tract and quickly distributed to tissues through blood flow. There is evidence that chronic occupational exposure to Xylenes is associated with neurological effects. The m, o and p isomers of Xylenes vary somewhat in their capacity to affect different organs and have been associated with kidney injury and renal carcinomas.

Carbon disulfide** - CAS Number 75150 (carbon bisulfide, Dithiocarbonic anhydride)/Carbonyl Sulfide – CAS Number 463581

Multiple exceedences in both Short-term and Long-term ESLs were identified in this study. TCEQ has identified Carbon disulfide with a double asterisk (**) indicating the potential for disaster associated with this chemical. Carbon disulfide is used in the production of viscose rayon and cellophane, pesticides and used as a solubilizer for waxes and oils. It is a volatile colorless liquid associated with an "ether-like" odor and often combined with carbonyl sulfide in commercial use. Although it has a distinct and unpleasant odor the ESLs associated with this chemical are based on the adverse health effects rather than the noxious odor. It is highly flammable and highly reactive. At high concentrations may be life-threatening due to its central nervous system suppression. Physical signs of milder exposure may result in nerve damage to the lower-lateral leg and foot resulting in foot drags or mild limp.

Napththalene – CAS Number 91203

Napththalene was shown to exceed Long-term ESL according to TCEQ limits. Naphthalene (Naphthalin or antimite) is structurally composed of two benzene rings fused together. It is commonly found in mothballs and is known for its' volatility and inflammable vapor. Napththalene in hydrogenated form is often used as low-volatility solvents in industrial operations. Exposure to large amounts of Napththalene may damage or destroy red blood cells and can lead to hemolytic anemia, often seen in children who have ingested mothballs. Symptoms related to low level exposures include fatigue, lack of appetite, restlessness and pale skin. Exposure to higher levels of Naphthalene may result in nausea, vomiting, diarrhea, blood

in urine and jaundice. The International Agency for Research on Cancer (IARC) classifies Naphthalene as potentially carcinogenic to humans and animals. Acute exposures have also been correlated to cataracts in humans.

Dimethyl disulphide – CAS Number 624920

Dimethyl disulphide exceedences occurred in both Short-term and Long-term ESLs according to TCEQ limits. The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) for Dimethyl disulphide is 0.5 ppm, 1.9 mg/$m^3$ TWA, which is considerably lower than TCEQ limits. Health factors associated with exposure to Dimethyl disulphide include irritation of the respiratory system (nose, throat) as well as eye and skin irritation. Dimethyl disulphide is known to cause nausea and overall weakness. Vapor or air mixtures of Dimethyl disulphide above 24 °C may be explosive.

Methyl ethyl disulphide – CAS Number 20333395

Methyl ethyl disulphide, (methyldisulphanylethane) is known for its highly offensive odor. Although stable it is known to be highly flammable. Like Dimethyl disulphide, Methyl ethyl disuphide is a known eye and skin and respiratory irritant.

Trimethyl benzene, Diethyl benzene, Methyl-methylethyl benzene, Tetramethyl benzene, 1,2,4-Trimethyl benzene – CAS Numbers 25551137, 25340174, 25551137, 95932

This category of benzene isomers have numerous exceedences in both Short-term and Long-term ESLs in this particular study. This family of isomers are aromatic hydrocarbons known for the capability as a solvent. These compounds present with an aromatic sweet odor and are known for their flammability and combustibility. They are also identified as hazardous and may contain similar adverse effects on humans as benzene.

Ethyl pyridine, 2-Methyl pyridine, and Diemethyl pyridine – CAS Numbers 536787, 109068, 5453678

Pyridine metabolite exceedences in both Short-term and Long-term ESLs were reported in this study. These compounds are simple aromatic heterocyclic organic compounds used as a solvent and reagent. It is structurally similar to benzene and has a distinctive fish-like odor. It is highly reactive and is a precursor to numerous products (herbicides, insecticides, pharmaceuticals etc). Effects of acute pyridine exposure include dizziness, headache and nausea. It is currently being evaluated as a possible carcinogenic agent by government agencies.

Ethyl, methylethyl disulfide, Dimethyl trisulfide, Ethyl n-propyl disulphide

Although these compounds may vary in CAS Number they can be considered metabolites of the same basic chemical with the inference for use of similar Short-term and Long-term

exceedences. Laboratory results indicate a presence in levels that exceed ESL for disulfides both at Short-term and Long-term ESLs. This family of compounds is known both for its flammability and potential for offensive odor. They are known eye, skin and respiratory irritants with caution for respiratory exposures

## 8.0 Conclusion

Air analysis performed in the Town of DISH confirmed the presence in high concentrations of carcinogenic and neurotoxin compounds in ambient air near and/or on residential properties. The compounds in the air indicate quantities in excess of what would normally be anticipated in ambient air in an urban residential or rural residential area. Many of these compounds verified by laboratory analysis were metabolites of known human carcinogens and exceeded both Short-term and Long-term effective screening levels (ESL) according to TCEQ regulations. Of particular concern are those compounds with the potential for disaster as defined by TCEQ. This study is not to be considered a comprehensive study but rather a baseline assessment that allows for further monitoring of ambient air conditions. As many of the compounds are highly reactive, additional testing may indeed identify further compounds that were not identified in this study due to their basic nature of rapid and constant formation of varying metabolites. Furthermore, the lack of presence of compounds at specific sites, or levels below ESL should not be construed as safe limits of exposure. Rather, on the specific date of testing, given the wind patterns it is possible that those locations did not record the presence of emissions but given other wind patterns may indeed show exceedences as recorded at other locations.

Active monitoring is highly recommended with additional testing on a quarterly basis. Further recommendations may be warranted by the Texas Department of Health.

## 9.0 Statement of Confidentiality

This report was prepared exclusively for the use and reliance of The Town of DISH, Texas ("Client"). The contents shall not be disseminated, in whole or in part, without the written consent of any authorized representative of same. The findings of this report shall not be used by, or conveyed to any other party without prior written consent of Wolf Eagle Environmental. The scope of this report is specific to Client, and may not be suitable for other users. Wolf Eagle accepts no responsibility for the unauthorized manipulation or misuse of this report whether intentional or incidental.

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